

Appendix A

Sampling and Analysis Plan Standard Operating Procedures and Field Forms

STANDARD OPERATING PROCEDURE 1

Test Pit Excavation and Sampling/Piezometer Installation/Water Level Measurements

Scope and Application

Test pits will be excavated at 12 locations within the Little Squalicum Park boundaries to further evaluate areas of historical landfill and gravel pit operations, which might have disturbed soils and distributed contamination throughout a depth range up to several feet. Soils will be collected from 1 ft intervals to an approximate depth of 3-4 ft using a stainless steel shovel, trowel, or spoon.

Three test pits (TP-3, TP-6, TP-12) will be excavated deeper (~6 ft) and piezometers will be installed while backfilling the hole to monitor groundwater levels at these locations. The piezometers will be 1-inch in diameter and made of PVC or stainless steel with slotted screens the entire depth of the installation.

Equipment and Reagents Required

- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)
- Site logbook and test pit log
- Indelible black-ink pens and markers
- Camera
- Backhoe and operator
- PVC or stainless steel piezometer
- 10-20 Silica sands (if required)
- Well monument, concrete, cap and lock
- Electronic water level indicator
- Stainless steel spoons, trowel, shovel, bowls
- Photoionization detector (PID)
- Plastic sheeting
- Paper towels

- Sample containers
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample labels and appropriate documentation
- Assorted geology supplies (e.g., hand lens, grain size card, scales, etc.)
- Decontamination equipment (SOP-8)

Procedures

Test Pit Excavation

1. Using a backhoe, remove the upper 1-2 ft of soil from an area approximately [5 ft by 5 ft] square, and place to one side of the excavation.
2. Continue the excavation downward using the backhoe, placing the soils on the opposite side of the excavation. Extend the pit vertically and horizontally until the appropriate depth and width are obtained (3-4 ft depth proposed for this project).
3. Collect samples at 1 ft intervals to a depth of 3 feet, and from the bottom of the pit using a stainless steel shovel, trowel or spoon. Personnel shall not enter an excavation if it is more than 4 feet deep. If deeper than 4 ft, use the backhoe bucket to collect a sample.
4. Place soil from desired depth directly into a stainless steel bowl for compositing. Collect soil from all sides of the excavation for each sample depth to provide enough material for analysis.
5. Homogenize soil within bowl/pan with decontaminated stainless steel trowel or spoon. Remove rocks, twigs, leaves and other large debris as appropriate. Fill sample containers for analytical parameters. (Volatiles samples should not be composited but collected from a discrete location within the depth interval.)
6. If groundwater with sheen or odors is encountered, collect a water sample. A sample from less than 4 feet in depth may be obtained by direct fill into bottles (if possible) or by using a decontaminated stainless steel scoop. A sample from a deeper depth should be collected using a stainless steel beaker clamped to a pole (or equivalent). Care should be exercised when pouring the water into the appropriate sample containers as not to aerate the sample. Personnel shall not enter an excavation if it is more than 4 feet deep.

7. Sketch a map of the trench showing the location (horizontally and vertically) of any stained soil layers, samples, buried wastes, etc. in the field notebook and/or on a test pit record form. Describe soil in accordance with ASTM D2488 on the sample log form.
8. Label and manage sample containers in accordance with SOP-7 for shipping and handling of samples.
9. Decontaminate sampling equipment in accordance with SOP-8.
10. Document activities in site logbook.
11. After completion of the trench or at the end of the day, whichever is more frequent, backfill the test trench(es). The soils from the deeper portion of the trench shall be returned to the trench first. If a trench was not completed and is backfilled at the end of a day, it may be restarted the next day from the point at which excavation ceased.
12. Mark the boundaries of the test pits and the ground surface location(s) of any soil/groundwater samples with stakes for subsequent surveying. Perform re-vegetation of the area as necessary and required.

Piezometer Installation

1. Once test pit has been sampled for chemical analysis as described above, excavate pit deeper until groundwater is encountered (~6 ft bgs).
2. Install 1-inch PVC or stainless steel piezometer with pre-packed slotted screen 2-3 feet below groundwater level if possible.
3. Backfill test pit around piezometer (soils are expected to be predominately coarse-grained materials (sands and gravels). If test pit soils are fine-grained, install 10-20 silica sand filter pack from 1 foot below the screen to a maximum of 3 feet above the screen, and then backfill test pit.
4. Cut PVC riser (for surface completions). Record cut length in site logbook.
5. Install concrete pad (minimum 3 feet by 3 feet by 6 inches) and locking protective monument (stand-pipe for each location). Install three bucking posts for standpipe completions, if necessary.

6. A lockable cap will be attached to the top of the casing. A protective cover, level with the ground surface, will be installed with a waterproof seal to prevent the inflow of surface water.
7. Decontaminate all equipment (SOP-8).
8. Document activities in the site logbook.
9. Ground surface at each piezometer will be surveyed to provide horizontal coordinates (northing/easting) and elevation.

Water Level Measurements

1. Rinse water level indicator probe and cable with deionized water and wipe dry with paper towels.
2. Holding cable reel atop casing, lower indicator probe gradually into well until tone and/or light indicates contact with water surface.
3. Grasp cable exactly at the measuring point marked at the top of the well casing with thumb and index finger. Pull cable out of well slowly to read measurement.
4. Record measurement depth to water surface to the nearest 0.01 ft as indicated on graduated cable.
5. Withdraw cable several feet then lower and repeat Steps 2-4. If readings differ by more than 0.2 ft, repeat until readings stabilize.
6. Remove cable and probe from well and rinse with deionized water.

STANDARD OPERATING PROCEDURE 2

Hand Auger Sampling

Scope and Application

Hand augers will be excavated at 8 locations within the Little Squalicum Park boundaries to evaluate soils along the Burlington Northern Santa Fe (BNSF) railroad right-of-way and an area northeast of Little Squalicum Creek suspected to be impacted by a historical OESER spill or contaminated runoff. Soils will be collected from 1 ft intervals to an approximate depth of 2 ft using a stainless steel hand auger or equivalent.

Equipment and Reagents Required

- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)
- Site logbook and hand auger log
- Hand auger, drive sampler, or equivalent
- Indelible black-ink pens and markers
- Camera
- Stainless steel spoons, bowls
- Photoionization detector (PID)
- Sample bottles
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample labels and appropriate documentation
- Assorted geology supplies (e.g., hand lens, grain size card, scales, etc.)
- Decontamination equipment (SOP-10)

Procedures

1. Remove vegetation in area of station.
2. Use hand auger/drive sampler to bore into subsurface soil to a depth of 1 ft below ground surface (bgs).

3. Empty soil from hand-auger/drive sampler cuttings directly into a stainless steel bowl for compositing. Collect enough soil from each depth interval for required analysis – this may require compositing up to 3 replicate samples at each station.
4. Describe soil in accordance with ASTM D2488 on the sample log form.
5. Homogenize soil within bowl/pan with decontaminated stainless steel trowel or spoon. Remove rocks, twigs, leaves and other large debris as appropriate. Fill sample containers for chemical parameters. (Volatiles samples should not be composited but collected from a discrete location within the depth interval from one auger sample.)
6. Collect the next depth interval (1-2 ft) and follow the same compositing procedures. Care should be taken in collecting representative soil from each depth interval.
7. Label and manage sample containers in accordance with SOP-9 for shipping and handling of samples.
8. Backfill sampling hole with remaining hand auger/drive sampler cuttings.
9. Decontaminate sampling equipment in accordance with SOP-10.
10. Document activities in site logbook.

STANDARD OPERATING PROCEDURE 3

Groundwater Sample Collection

Scope and Application

Groundwater samples will be collected from three locations within the Little Squalicum Park boundaries and one background location to be determined. There are two sampling rounds planned for this investigation, once in the wet season and once in the dry season. The wet season samples will be collected between October and May the dry season samples between June and September.

Equipment and Reagents Required

- Sampling and Analysis Plan (SAP)
- Site logbook
- Indelible black-ink pens and markers
- Sample tags/labels and appropriate documentation
- Appropriate laboratory glassware
- Oil/water interface probe (if necessary)
- Water level meter
- Groundwater parameter multi-meter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- Flow-through cell
- Field alkalinity test kit
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers, coolers, and blue ice or equivalent
- Sampling equipment (one or more of the following): Peristaltic pump; disposable, dedicated bailers; Grundfos Redi-Flow submersible pump (or equivalent); Reel E-Z® system including control box; portable generator (5,000 watt minimum)
- Water Sampling Log Forms
- Decontamination equipment (SOP-10)

Typical Procedures

Preparation:

1. Record necessary data in site logbook.
2. Prepare sampling equipment including calibration of field meters prior to use.
3. Move equipment and supplies to sampling location.
4. Decontaminate equipment according to SOP 10.

Purging:

1. Remove well cap.
2. Measure light nonaqueous phase liquid (LNAPL) thickness (if present), measure static water level and total depth of well.
3. Remove the pump from the pump holder and rinse the pump off with distilled water. After consulting the well log to determine depth to the middle of the well screen, slowly lower the pump into the well. Position the pump at the middle of the well screen.
4. Connect the discharge hose and cable for the control box to the Reel E-Z[®] system. Start the generator and set it to 120 volts. Make sure the generator is kept downwind from the sampling system.
5. Place the discharge hose in the flow-through box. Place the probes for the calibrated field meters into the flow-through box. Place a bucket beneath the flow-through box to catch purged water.
6. Turn on the pump and adjust flow rate to approximately 2 liters per minute.
7. After approximately 4 liters of water have been purged from the well, adjust the flow rate to 1 liter per minute.
8. Start recording field parameters every 4 liters of water purged. Purging should continue at a constant rate until the selected parameters shown below have stabilized for three consecutive measurements.

Field Parameter	Stabilization Criteria
Temperature	$\pm 1^{\circ}\text{C}$
pH	± 0.1 pH units
Specific Conductance	± 5 percent
Dissolved Oxygen	± 10 percent
Redox Potential (Eh)	± 50 mV
Turbidity	± 10 nephelometric turbidity units (NTUs)

Sampling:

1. After specified parameters have stabilized, turn down flow rate on control box so pressure is maintained in the system to stop water from entering well and minimize or stop water from exiting the well.
2. Disconnect discharge hose from Reel E-Z[®] system.
3. Connect Teflon[®] sampling tube to Reel E-Z[®] system. Place bucket beneath sampling tube to catch unsampled water.
4. Turn up flow rate slightly and fill necessary sample bottles. If sampling for volatile organic compounds (VOCs), flow rate should be just enough to create a trickle of water. If sampling for other analytes, adjust flow rate to 1 liter per minute.
5. Samples collected for dissolved metals shall be field filtered by connecting a 0.45 micron in-line filter to the sampling tube. Dispose of filter after each sample.
6. Label and manage sample containers in accordance with SOP 9 for shipping and handling of samples.

Documentation:

1. Fill out one Water Sampling Log Form for each sample collected with all necessary information recorded in the site logbook.